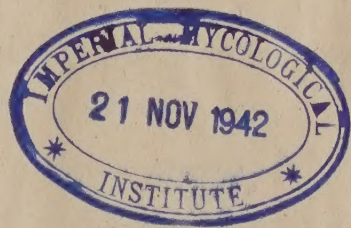


NYASALAND PROTECTORATE



Annual Report
of the
Department of Agriculture
1941

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Report of the Director of Agriculture.

PART I—AGRICULTURE IN NYASALAND.

WEATHER CONDITIONS.

Throughout the Southern Province the season was the driest experienced for a great many years. The rains commenced at the normal time but precipitation was scanty and ill-distributed and from the middle of March onwards there was a severe drought. Most places received only about half of their normal rainfall and some even less. All crops suffered more or less severely, tobacco probably being the least affected. Rainfall in the Northern Province was also below average but there was much local variation. Dry, unfavourable weather prevailed in the early part of the season, but in the period January to March there was more rain than usual and as a result the Northern Province did not suffer from drought in any way comparable with the Southern Province.

Throughout the Protectorate very low temperatures were recorded in the cold season and in June and July frost damage to vegetables, bananas, etc. was common throughout the highlands, while even in the tea areas some frost damage was observed in patches along stream banks or in low hollows.

The Shire River maintained a high level throughout the year, the lowest level, in October 1941, being but a few inches below that of October, and the highest level, in March, only three feet less than in 1940.

Rainfall figures from representative stations throughout the Protectorate are shown in the table below.

Station	Zone	Total rainfall November 1, 1940, to April 30, 1941, Inches	Normal for six wet months Inches	Total rainfall May to October 31, 1941, Inches	Normal for six dry months Inches
Port Herald Experimental					
Station ...	A	18.08	28.8	0.96	3.2
Chikwawa ...	...	11.30	29.7	0.10	2.3
Cholo ...	B	27.88	48.8	8.23	8.1
Makwasa ...	...	29.90	46.8	3.56	4.4
Mlanje ...	C	35.08	66.6	9.77	14.5
Chitakali ...	...	38.80	65.6	10.11	12.1
Thornwood ...	...	43.55	67.8	4.58	11.6
Ruo ...	...	37.21	53.7	3.91	6.3
Glenorchy ...	...	30.77	56.2	17.95	10.1
Lujeri ...	...	64.07	76.3	9.86	14.3
Nalipiri ...	D	34.73	51.9	10.04	11.0
Blantyre ...	E	17.94	39.9	1.27	3.3
Chiradzulu ...	...	19.90	40.0	1.60	2.5
Nasonia ...	G	24.45	36.9	5.62	1.9
Zomba Experimental					
Station ...	H	34.48	46.8	1.57	4.6
Zomba Plateau ...	...	38.95	—	2.75	—
Zomba Police Headquarters ...	...	36.13	41.9	2.24	1.8
Mwanza ...	K	26.62	37.2	2.61	.6
Liwonde ...	L	54.27	31.7	—	1.1
Namwera ...	M	36.37	42.2	1.92	.3
Chipunga ...	...	29.92	35.0	3.36	.8
Fort Johnston ...	N	20.95	29.4	0.62	1.2
Ncheu ...	P	33.61	37.0	0.32	.9
Likuni ...	S	41.99	32.9	0.62	1.5
Lilongwe ...	...	38.01	32.7	0.44	.8
Dowa ...	T	35.81	33.1	0.18	.7
Fort Manning ...	...	38.03	39.8	0.80	2.5
Domira Bay ...	U	32.37	31.0	—	.1
Dedza ...	V	39.30	39.7	0.93	2.2
Kasungu ...	X	36.91	29.1	0.99	.3
Mzimba ...	...	34.87	31.7	—	.2
Kota Kota ...	Y	48.04	48.2	0.23	2.0
Chintche ...	Z	41.13	62.9	6.62	5.1
Karonga ...	...	38.34	52.3	0.71	2.8

PRODUCTION AND EXPORT.

European production and acreage of the principal crops are given in the following table :

	Acres	Yields		Acres	Yields
Tea ...	18,896½	12,872,412 lb.	...	824½	6,340 cwt.
Coffee ...	95½	144½ cwt.	...	157	205½ cwt.
Tobacco ...	7,685½	3,803,884 lb.	...	1,310	1,749 cwt.

Native production and numbers of growers for the two principal crops, viz. cotton and tobacco, are as shown below.

	No. of growers	Amount sold
Cotton (seed cotton) ...	34,064*	2,901 tons
Tobacco ...	77,720	8,912 tons

* Approximate.

The exported amounts and values of the various items of agricultural produce and of raw materials were as follows :

	Amount	Value
		£
Beeswax ...	12,004 lb.	500
Capsicums and Chillies ...	23,242 lb.	290
Cotton (lint) ...	558 tons	18,238
Fibre (all kinds) ...	371 tons	4,450
Potatoes ...	168,659 lb.	539
Rice ...	330,000 lb.	1,473
Rubber ...	205,875 lb.	4,289
Soya Beans ...	1,459,540 lb.	2,606
Strophanthus ...	14,931 lb.	1,493
Tea ...	12,282,614 lb.	562,953
Tobacco leaf dark-fired ...	7,441,496 lb.	275,056
leaf flue-cured ...	2,884,606 lb.	108,173
leaf air-cured ...	486,534 lb.	18,245
strips dark-fired ...	5,264,376 lb.	197,414
strips flue-cured ...	260,495 lb.	9,769
strips air-cured ...	1,224,016 lb.	45,901

In comparison with the year 1940 these figures show relatively small decreases in the exports of rice and tea, rather larger decreases in strophanthus and beeswax, and a big fall, of 626 tons, in the amount of cotton. Exported amounts of other products show increases, especially of soya beans where the amount has been more than doubled, and of tobacco, export of which has increased by over four million pounds. There is a decrease of over a million pounds in the quantity of air-cured leaf, but an increase in all other types, particularly of fire-cured which is up by nearly four and a half million pounds.

TOBACCO.

In the Southern Province conditions were unfavourable during the planting season owing to inadequate and ill-distributed rainfall, but dry weather favoured the crop during the ripening and curing period and resulted in quality being much above average in all types, the European flue-cured crop being one of the finest ever produced in the country. Difficulties due to dry weather were also experienced in the Northern Province at planting time but subsequently unusually heavy rains fell and had a detrimental effect on quality. The total tobacco crop which amounted to 22,153,566 lb. was the largest ever produced in the country, exceeding the previous 1932 record of 19,477,778 lb. by 2,675,788 lb. The largest increase was in the native grown fire-cured type which was 5,383,635 lb. more than the amount produced in 1940. Actual figures for production of the various types in 1941 were :

<i>European</i>	lb.
Flue-cured ...	3,302,404
Fire-cured ...	389,088
Air-cured ...	112,392
	<u>3,803,884</u>
 <i>Native</i>	 lb.
Flue-cured ...	276,558
Fire-cured ...	15,484,077
Air-cured ...	2,589,047
	<u>18,349,682</u>
Total	<u>22,153,566</u>

EXPORTS.

	Amount lb.	Value £
Flue-cured	3,145,101	117,942
Fire-cured	12,705,872	472,470
Air-cured	1,710,550	64,146
	<u>17,561,523</u>	<u>654,558</u>

The number of registered Native Trust Land growers and the average amount of tobacco produced per grower were as follows:

<i>Northern Province</i>	<i>Southern Province</i>
47,005 166.1 lb.	9,732 206.4 lb.

The amounts of tobacco purchased from growers on Native Trust Land and Private Estates respectively are shown below:—

	<i>Northern Province</i> lb.	<i>Southern Province</i> lb.
Native Trust Land	7,807,582	2,008,848
Private Estates	5,953,870	2,579,382
	<u>13,761,452</u>	<u>4,588,230</u>

The quantities, to the nearest 1,000 lb., of the different types sold on the licensed auction floor at Limbe and the average prices were as follows:—

	Amount	Average price per lb.
Fire-cured	9,029,000	6.28d.
Flue-cured	3,918,000	9.87d.
Air-cured	723,000	6.26d.

COTTON.

The total number of growers in the whole Protectorate was approximately the same as in 1940. Production, however, was very much reduced owing to the very dry season in the Southern Province. In the Lower River area the acreage under cotton was much less than in 1940 owing to the fact that individual gardens were smaller, and because many natives, although they prepared land and took seed, were unable to plant for lack of rain. Fully half the acreage planted in this area failed completely and everywhere the plants ceased flowering and died after the main crop had been harvested in June and July. Drought alone was the limiting factor as insect attack was comparatively light. In the Northern Province high yields per acre were obtained in Kota Kota, Dowa, Dedza and Ncheu and production in these districts was 47 per cent. greater than last year. The rains, although less than usual, were well distributed and therefore adequate for the crop. Insect pest attack was relatively slight, partly because the drier weather was unfavourable to its development and partly because the close season had been rigorously enforced. In the North Nyasa District the rains were shorter and more erratic and the crop was about the same as last year. The total production in the Northern Province showed an increase of 28% on that of 1940.

Details of Trust Land and Private Estate seed cotton production by districts were as follows:—

<i>Southern Province</i>	<i>Northern Province</i>
Lower Shire	Ncheu
Chikwawa	Dedza
Cholo	Dowa
Mlanje	Kota Kota
Blantyre	North Nyasa
Central Shire	
Upper Shire	
South Nyasa	
<u>1,755 tons</u>	<u>1,146 tons</u>

The total of 2,901 tons of which private estates produced 396 tons shows a decrease of approximately 17.4 per cent. on last year's figure.

The cotton was bought in two grades only this year: "Good", which averaged 1.08 pence per lb., and "Ordinary" which averaged 0.299 pence per lb. The total sum paid out to Native Trust Land growers was £24,259.

The following table shows an improvement over 1940 in yields and production factors in the Northern Province and reflects the bad season experienced on the Lower River:—

Area	Yield per acre lb.	Production factor per lb. cotton seed issued	% Sold as "Good"
Lower River ...	103	1.9	92.91
Blantyre and Central Shire ...	166	3.4	95.64
Central and Northern Areas ...	340	6.7	98.98
North Nyasa ...	440	5.8	93.10

European production of seed cotton amounted to 8 tons.

TEA.

For the first three months of the year tea estates obtained normal yields, but the extremely dry weather which followed resulted in greatly reduced yields and a severe setback to the bushes. Fortunately the greater part of the tea growing area received an unexpected torrential downpour of rain at the beginning of September and this saved the situation on the majority of estates. Had there been no rain until October or November, as is usually the case, there is no doubt that the bushes would have suffered much more severe and more permanent damage. There was a widespread re-appearance of the "Yellows" disease, due to sulphur deficiency during the dry period, presumably because lack of moisture prevented the bushes from absorbing the available sulphur in the soil. The labour position both in Mlanje and Cholo was generally more satisfactory than usual. Progress in provision of good housing, better diets and medical attention for native labour continues to be made.

TUNG.

The area under this crop has continued to expand and further plantings during the year brought the total acreage to 5,830 acres, most of which is in the districts of Cholo, Mlanje, Blantyre and Zomba. All the new plantations established in the last two or three years have been with the species *Aleurites montana*, which now makes up most of the total acreage.

Approximately 7½ tons of seed were exported during the year. By the end of the year a factory for the extraction of tung oil had been completed. The size of the crop is likely to increase rapidly during the next few years as a large area is now coming into bearing.

MINOR CROPS.

Production in tons, surplus to local food requirements, of some of the minor crops from certain districts is indicated in the following table:—

District.	CROP						
	Maize	Ground-nuts	Beans and Pulses	Wheat	English Potatoes	Simsim	Rice
Lower Shire ...	—	4	—	—	—	6	52
Chikwawa ...	—	2	—	—	—	3	20
Central Shire ...	—	6	1	6	—	—	—
Blantyre ...	128	10	—	—	70	2	—
Mlanje ...	2,009	5	20	—	—	—	20
Cholo ...	547	3	—	—	15	—	8
Chiradzulu ...	330	2	—	—	20	3	—
Zomba ...	90	3	—	—	40	2	5
Upper Shire ...	—	50	—	—	—	—	10
South Nyasa ...	—	2	—	—	—	—	5
Ncheu ...	718	2½	68	8	—	—	—
Dedza ...	483	48½	40	89	119	—	11
Kota Kota ...	—	—	33	—	—	—	650
TOTALS ...	4,305	138	162	103	264	16	781

Rice production for sale would have been much greater had it not been for the weather and shortage of other foodstuffs. Thus, in the main production area of Kota-Kota, the area under rice again expanded but much of the crop was kept for food or sold to natives from the hills. The position was similar on the Dedza lake-shore area and on the Lower River.

NATIVE FOOD CROPS.

The extremely short rainfall of the 1940-41 season played havoc with all native food crops in the Southern Province. Maize suffered least and gave relatively good crops in the hills and foothills, but on the plains it was either a complete failure or gave a very poor yield. Bulrush millet and sorghum, which provide the main food supply of the Lower River area, failed completely, the former due to drought alone and the latter due to the combined effect of drought and a very heavy attack of stem-borer. Pulses were bad throughout the province, and some types were so short that there was insufficient seed for planting at the beginning of the 1941-42 rains. Groundnuts were but little better, yields being much reduced by the widespread occurrence of rosette disease as well as by lack of rain. The whole of the Lower River area suffered from food shortage, which might have developed into a serious famine but for the importation of 141 tons of sweet potato cuttings which were issued to natives for planting on dimba land and provided a valuable additional food supply from September onwards. Food was also scarce by the end of the year in many villages on the Palombe, Central Shire and Upper Shire plains, but supplies were available from their more fortunate neighbours.

In the Northern Province the position was satisfactory, an excellent crop of maize being obtained almost everywhere. Beans were poor in many places but in several districts considerable surpluses were available for sale. Groundnuts gave low yields everywhere.

PESTS AND DISEASES.

In spite of the fact that the 1940-41 season was the driest for a great many years there was no unusual development of insect pests, with the exception of a serious attack by stem-borer (*Chilo* sp.) on sorghum.

LOCUSTS.

The only species of locust occurring in the Protectorate during the year was *Nomadacris septemfasciata*, Serv., and activity was confined to the southern half of the country. Hatching of hoppers (15th generation) occurred fairly extensively in the Lower River area in January, and bands, generally of no great size, were also present in the Shire Highlands, Mlanje, Dedza and Ncheu districts from January to March. Wherever possible, poison spraying, dusting and beating were carried out and a large number of bands were destroyed or much reduced in size. Flying swarms developed by the second week in March in the Lower River areas and during March and April elsewhere. Some of the swarms were very large, and they were particularly numerous in the vicinity of Mlanje mountain. In September and October swarms reached Zomba, Cholo, Chiradzulu, Mlanje and Ncheu. Egg-laying (16th generation) was only reported, however, from three places; two near Chiromo on the 24th and 30th November, and one at Mpemba, south of Port Herald on the 30th December, none of them on an extensive scale. Locusts did little damage to food crops compared with the effect of the drought and of stem-borer.

CROP PESTS.

COTTON. The work of the Insect Pest Control section of the Empire Cotton Growing Corporation on the major pests of this crop is summarised in Part II of this report. The Pink Bollworm, (*Platyedra gossypiella*, Saunders.) was not much in evidence in the Lower River districts this season. This may indicate the advantage of a well conducted "close season" campaign as this measure has proved helpful in restraining the attack of the Red Bollworm (*Diparopsis castanea*, Hmps.) at the Nkwale Experimental Station. At any rate there is no question that the policy of a dead season between crop and crop, with as complete a destruction of cotton refuse as is possible, must be rigorously adhered to each year as long as cotton remains the chief cash crop of any area.

TOBACCO. No serious outbreak of any field pest was reported during the year.

TEA. The Gelatine Grub (*Niphadolepis alianta*, Karsch.) was not to be found in numbers anywhere this year; and both the mealy-bug (*Pseudococcus perniciosus*, N. and W.) and red spider appeared on a smaller scale than usual.

TUNG. This crop has remained free from any serious insect depredations, but it receives attack, in varying degree of intensity, from a considerable number of scale insects of different kinds. The commonest of these are the flat scales of the genus *Aspidiotus*, mainly *A. hederæ*, Vall, and two bark burrowing scales, *Howardia biclavis*, Comst., and *Clavaspis herculeana*, Doane and Hadden, the latter being very generally distributed throughout the tung plantations. With few exceptions the attacks of scale insects so far observed do not seem to have had any detrimental effect on the trees. A mealy-bug (*Pseudococcus longispinus*, Tang.) heavily infested some trees of *Aleurites montana* at the Zomba Experimental Station, and on some of these trees young shoots were completely killed, but it would be difficult to assign the damage solely to the mealy-bug as the cause might well have been a combination of poor soil, the very dry season, and the insect.

SORGHUMS. There was a very serious attack by the Stalk Borer (*Chilo? simplex*, Butl.), particularly in the Lower River Districts. Parasitism by *Apanteles sesamiae*, Cam. which was noted in a previous outbreak in the Fort Johnston area in 1928-29, appeared to be entirely absent. It would appear that, in the case of a serious outbreak of this nature, it would be desirable to burn all plant refuse as soon as it is realised that the crop is a failure.

ADVISORY BODIES AND POLICY.

Tobacco is pre-eminently the cash crop of the African, and the Native Tobacco Board, under the Chairmanship of the Director of Agriculture, continued to direct the production and marketing activities of the crop produced by natives on Trust Land. The increase in production was brought about by increased efforts on the part of the existing growers rather than by the simple expedient of increasing their numbers. The Tobacco Control Board dealt with the sales of tobacco on the Auction Floor and other cognate matters.

In order to co-ordinate the work of the various competent authorities, controllers of agricultural produce and the inter-dependent industries and trades, a Supply Board was constituted with the Director of Agriculture, as Food Controller and Controller of Essential Supplies, as Chairman, and the Controller of Customs as Import and Export Licensing Officer as Deputy Chairman. The functions of the Board are to deal with local problems connected with the control and distribution of supplies and to maintain contact with the Nyasaland, Northern and Southern Rhodesia Inter-Territorial Conference and, through the Secretariat, with the Supply organisations of the Union of South Africa and of East Africa.

Shipping difficulties necessitated a review of the production and marketing policy in regard to those economic crops which are exported overseas and an *ad hoc* committee was set up under the Chairmanship of the General Manager, Nyasaland Railways, to formulate alternative plans for the disposal and marketing of the main crops produced in the Protectorate.

By means of the above the Director was able to maintain close contact with officials and non-officials and with their helpful assistance and co-operation, to implement the Government's Agricultural policy of self-sufficiency.

On page 10 of the Annual Report for 1940 the agricultural policy of the Protectorate was defined. It is unnecessary to repeat it. The aim was self-sufficiency in all essential agricultural products which could be grown within the Protectorate so that imports from overseas could be eliminated or reduced and valuable shipping space released. Another important factor was that the fulfilment of such a policy would inspire greater confidence in our ability to meet any circumstance which might arise from any permanent or temporary dislocation of essential supplies from outside sources.

The wide range of climatic and soil conditions made it comparatively easy to plan a self-sufficiency programme; the difficulty was to plan it wisely and to utilise the resources of the country to the best advantage. In common with other colonies a very appreciable percentage of the country's productive man-power is with the armed forces or is employed as labourers on productive war work in the Union of South Africa and the Rhodesias. The European supervisory staff has been reduced to a minimum and the distribution of population coupled with high freight and transport costs present economic problems which cannot be lightly ignored. The details of the results achieved are contained under the various sections in the body of this report but a brief record of the main economic crops and staple food crops would not be out of place here.

The two main economic crops are tobacco and tea. The total tobacco crop amounted to 22,153,566 lb. which is the largest ever produced in the country. The increase was in native grown fire-cured types which was 5,383,635 lb. above the 1940 crop. The severe drought reduced tea yields and exports showed a slight decline the amounts being 12,794,314 lb. in 1940 as against 12,282,614 lb. in 1941 a decrease of 511,700 lb. There was an increase in the production of soya beans and 1,459,540 lb. were exported as against 674,410 lb. the previous year. In regard to the food crops produced for local consumption the requirements of the military and civilian populations were fully met. Groundnuts were in short supply owing to the poor season and local varieties of beans were not plentiful but it was possible to export 168,659 lb. of European potatoes as against 41,217 lb. in 1940 while in spite of the increased local demand for rice 330,000 lb. were exported. Wheat, being the staple food of the Europeans, received particular attention. Formerly flour was imported from Australia and Canada. Samples of the locally-grown varieties were sent for milling and baking tests and the reports received were highly satisfactory. Fortunately varieties *Sabanero* and *Reward*, which are reported on as satisfactory for blending, have shown quite a high degree of immunity to "rust" and the cultivation of these varieties has been encouraged and a flour mill has been erected in Blantyre. In 1939 the estimated production of wheat was 38 tons. In 1941 it was 103 tons showing an increase of 170 per cent. Maize is the staple food of the African and after all requirements have been met surpluses of over 500 tons of maize are available for export or can be held in reserve. Considerable encouragement and assistance has been given in connection with the growing of vegetables and this has resulted in large quantities being made available for export particularly to the port of Beira and other centres in Portuguese East Africa. There is one essential commodity which cannot be obtained locally and that is salt which is imported from Portuguese East Africa and the Union of South Africa. Sugar is also imported but could, if the necessary machinery were imported, be manufactured locally as many areas are admirably suited to the production of sugar cane.

PART II—WORK OF THE DEPARTMENT.

STAFF.

The main staff changes are recorded in the staff list at the beginning of this report. Seventeen officers of the Department and the Native Tobacco Board were serving with the forces, *viz.*, the Assistant Agricultural Chemist, two agricultural officers, one assistant agricultural officer, two agricultural supervisors, eight of the Native Tobacco Board field staff, and three of the clerical staff. One supervisor resigned during the year. The only new appointment was that of Dr. C. W. B. Arnold as Agricultural Chemist and Tobacco Research Officer on October 1st following upon the departure of Dr. Black on military service in June. In the Southern Province Mr. E. Lawrence was in charge as Provincial Agricultural Officer with Mr. M. F. H. Selby as Agricultural Officer at Port Herald. Mr. H. W. T. Webb had charge of the Northern Province as Provincial Agricultural Officer with Mr. S. T. Hoyle, seconded from the Empire Cotton Growing Corporation, as Agricultural Officer at Ncheu. Mr. A. P. S. Forbes remained in charge of the Tea Experimental Station and in addition covered the district work in Mlanje and Cholo, and Mr. C. C. Webster continued at the Tung Experimental Station.

TRAINING SCHOOL FOR AFRICAN AGRICULTURAL INSTRUCTORS.

The object of this school, together with its organisation and the courses of instruction provided, were dealt with in some detail in the Annual Report of the Department for 1940 (pp. 11-12). During the year under review 18 students completed their first year at the School and proceeded to the second, and final, year of the course. Thirty seven new students, selected from all parts of the country by the Provincial Agricultural Officers and the Protectorate Tobacco Officer, commenced a six weeks' probationary course in October. At the end of this period 17 of these were selected to take the full two years' course, the high ratio of probationers to the number of vacancies in the school making it possible to demand a high standard in the entrance examination. The first 18 houses of a new school village were built during the dry season in order to provide housing for the wives and families of students who come from the more distant parts of the Protectorate, and it is proposed to extend this village so that the undesirable dormitory system may eventually be abandoned for all students. The experiment of making the students themselves partly responsible for school government has been tried with success, a committee of six under a school chief being appointed every two months.

In addition to the normal work of the school a special five-weeks' course in August and September was attended by 23 Africans already in the employment of the Native Tobacco Board. Classroom and practical instruction was given under five headings: (1) Measurement of areas; (2) Use of a road tracer level; (3) Soil erosion; (4) Role of organic matter in the soil and simplified compost making; (5) Fire-cured tobacco management of the crop from sowing to grading.

MARKETING OF NATIVE CROPS.

The scheme for the establishment of controlled marketing of various native grown products, other than cotton and tobacco, which had been inaugurated in the previous year, was enlarged and extended during 1941. Produce markets had previously been in operation only in the Mlanje and Cholo districts and during the 1941 season markets for maize, beans and groundnuts were established in the Blantyre, Chiradzulu, Zomba, Ncheu, Dedza and Lilongwe districts.

The marketing organisation has functioned well and to the mutual convenience and satisfaction of both purchasers and producers. Prices, which are not controlled, were generally satisfactory though a considerable volume of maize crossed the border from the Mlanje district to Portuguese East Africa where the prevailing price was considerably in excess of that obtainable locally.

Revenue for the establishment and maintenance of the markets is obtained by the levying of a fee of 1d. for every 100 pounds of produce sold. The amounts so collected exceed actual running expenses and the surplus is being accumulated with the intention of constructing permanent markets wherever and whenever funds become available. Two such markets are contemplated in readiness for the 1942 produce season. The total quantity of produce sold through the markets in 1941 was approximately as follows:

Maize	...	...	4,659 short tons
Beans	...	...	138 " "
Groundnuts	...	...	57 " "
Sesame	...	...	1 " "
Wheat	...	...	108 " "

The Marketing Officer has continued to be responsible for the affairs of the Kota-Kota Rice Society which enjoyed a prosperous season. Overseas supplies of rice to southern Africa now being unobtainable owing to war conditions, enquiries for very substantial quantities were received from South Africa, the Rhodesias and Portuguese East Africa, but as the demand within the Protectorate continued to be greater than the present production no export was possible. The Rice Society continued to make every endeavour to secure an increase in the production of paddy in order that advantage might be taken at the earliest possible time of the prevailing demand.

Assistance continued to be given to the military authorities in obtaining their foodstuff requirements. The Marketing Officer co-operated with the Commissioner for Italian Nationals in obtaining stores and equipment for the camps established to receive refugees from the war zones.

EXPERIMENTAL STATIONS.

As mentioned in last year's report, shortage of fully trained staff has necessitated severe curtailment of experimental work and some of the stations and sub-stations have had to be run on a care and maintenance basis for the past two years. In 1941 no experimental work was possible at Zomba, Likuni, Chimvua, Nchenachena and North Nyasa, and very little at Port Herald, but at all these stations observation and seed production plots of various crops have been maintained. The Makwapala station is now used entirely for the training of agricultural instructors and no land is available there for field experiments. Three full scale experimental stations have continued to operate normally, namely Nkwale (cotton), Mlanje (tea), and Chisawanu (tung).

PORT HERALD—No detailed experimental work was carried out on this station in 1941. Twenty two and a half acres of the land were under grass fallows which are being tested as a means of restoring soil fertility. The remainder of the station was devoted to observation and seed bulking plots of native grown crops, which included a collection of 45 sorghum varieties, imported varieties of short term millets (*Setaria* spp.), and long term *Pennisetums*.

MAŞAMBANJATI—Coffee grown at this sub-station on the single stem system and without shade has made little progress. Small scale experiments have now been commenced to find out if the use of shade, mulching, stripping, or pruning on the multiple stem system, will produce better results. Attempts to improve the condition of the older bushes by mulching and hard pruning do not give much promise of success, and it seems likely that new plots will be required for proper testing of the treatments mentioned above.

TEA EXPERIMENTAL STATION, MLANJE—All the experiments described in the Annual Report of the Department for 1938 (pp. 29-34), which had been placed on a care and maintenance basis during the absence of Mr. A. P. S. Forbes on active service in 1940, were recommenced when he returned to the station early this year. The results of two of the long term experiments, one on the residual value of cattle manure applied to tea, and the other on systems of pruning young Indian tea, have been published in the Nyasaland Agricultural Quarterly Journal, (Vol. 1, No. 3, pp. 24-32). Two new field experiments were begun; a spacing trial comparing bushes planted at 3½, 4, 4½ and 5 feet apart; and a manurial trial comparing four levels of application of sulphate of ammonia with and without sulphate of potash.

The bushes which were suffering from "Yellows" disease during the drought, owing to the fact that lack of moisture prevented their making use of available sulphates in the soil, were experimentally sprayed with a number of sulphur compounds. Results were not entirely conclusive but there was a strong indication that spraying with Bordeaux Mixture had a beneficial effect when applied early in the drought period.

Individual weekly leaf weight records were taken from some hundreds of high yielding bushes with a view to selecting the highest yielders for vegetative propagation. Rootstocks have been planted in preparation for a randomised block experiment to begin in 1943, in which the budded progeny of the ten best bushes will be compared.

TUNG EXPERIMENTAL STATION, CHISAWANU, CHOLO—This station was only opened late in 1940 and experimental work is therefore as yet in a very early stage. The most important line of work aims at the production of improved planting material by the selection of high yielding mother trees and their vegetative propagation. A survey of tung plantations which are in bearing has been carried out and the most promising trees have been picked out for yield recording over a period of several years, after which it will be possible to make a final selection of desirable types. The scope of this work is at present limited by the small area of *A. montana* which is not yet properly in bearing, but it will be extended from year to year. To date the survey has covered some 2,500 trees of *A. montana* and 12,000 of *A. fordii*. As the latter species appears to be far less promising under Nyasaland conditions than the former, it is proposed for the present to limit the work on *fordii* to selection from the area already surveyed, the testing of budded clones from the best trees, their comparison with selected and unselected seedlings, and investigation of the use of a *montana* rootstock. The programme of work in hand with *A. montana* is much more extensive. Some 22 of the best trees of this species have already been propagated as buddings and the resulting clones planted out in replicated experiments at the station. It is intended to establish further clones from a large number of the most promising trees so that the final selection of desirable types may be based on the performance of their budded progeny as well as on the yield and other characteristics of the mother trees themselves. Marked differences in vigour and growth habit between the clones are already apparent. Experiments have also been started in which buddings are being compared with selected and unselected seedlings, and the effect of budding *montana* on to *fordii* and *moluccana* stocks is being tested.

Reference was made in the Annual Report of the Department for 1940 (pp. 13 and 14) to the occurrence of approximately 40 per cent. of male trees in *montana* plantations and to the possibility of converting these males to profitable bearers by topworking. Work on topworking has been extended by experiments on private estates and very promising results obtained, the majority of the trees bearing a light crop of fruit one year after topworking and a relatively heavy one in the second year. Some losses have been experienced due to wind damage to the scions and further trials are therefore in progress to determine the best method and time for the work.

A start has been made with artificial cross and self-pollination amongst the best *montana* trees in order to produce families of legitimate seedlings. No extensive genetical or breeding programme is contemplated, but it is intended to make further budded clones from the most outstanding individuals of these legitimate seedling families, and by this combination of sexual and asexual propagation it is hoped to effect further improvement in planting material. The small amount of work done this year aimed at evolving a satisfactory technique and at determining to what extent self fertilisation of good trees is possible. An average of 33 per cent. of the artificial pollinations were successful.

Two cultural and manurial experiments with *montana* have been started at the station. One of these is an exploratory manurial trial in which all combinations of nitrogen, phosphate, potash and compost are being tested. The other compares the effect of intercropping amongst young trees with maize, soya beans, a green manure of velvet beans (*Mucuna* sp.), and a permanent cover crop of *Calapogonium mucunoides*.

EMPIRE COTTON GROWING CORPORATION: EXPERIMENTAL STATION, NKWALE—The following notes are taken from the 1941 Progress Report of the Cotton Specialist which will be published in the usual way by the Corporation.

Results this year at Domira Bay and in the areas which it represents continue to confirm the suitability of these areas for "summer crop" cotton, sown at the break of the main rains. Good average yields were obtained in spite of the short growing season consequent upon the rains starting late and ceasing early. The close season measures for the control of insect pests were again successful for the fourth year in succession, on the station.

The whole collection of high yielding strains, varieties and crosses which has been accumulated at the station was planted in small plots pending the results of the examination of lint samples sent to England, upon consideration of which it is intended to eliminate all below a certain standard of lint quality. Yields ranged from 374 lbs. seed cotton per acre for N. 17 from Uganda to 738 lbs. for the high yielding U4 × Cambodia × U4 cross HK. The most frequent yields were between 500 and 600 lbs. seed cotton per acre, 95 per cent. of the cotton being clean and white.

A small bulk trial, similar to that of 1939-40, was planted but suffered a grievous loss of stand from termite attack. Results were generally comparable with those obtained in last year's experiment. Termite damage to cotton has been common on the station where it has been grown on land which was previously resting under pigeon pea. Stand counts made systematically throughout the season showed that the damage done to cotton following pigeon pea was ten times as great as that done when cotton followed groundnuts. The main rotation has therefore been provisionally modified so that cotton will follow maize or groundnuts.

A standard strain trial, which suffered hardly at all from termites, gave the following results, (yields in lbs. seed cotton per acre):—

HK.— 2	738	" 920 "	523
N.H.— 7	634	N.C—4	520
H.L.— 4	625	S.P. 84	513
H.M.—18	575	Crown Land Bulk	486
" 561 "	562	N. 17	420

Significant difference = 114 lbs. $p = 0.01$.

The poor showing of N. 17 was due largely to its susceptibility to Jassid. The relatively good performance of "561", a cotton selected by Mr. D. Thornton at Ukiruguru, Tanganyika, is noteworthy, and this cotton is a possible rival to "920".

The cultivation experiment with cotton did not show statistically significant differences this year, although five out of the six leading treatments were "ridged" plots.

In 1939-40 an experiment was conducted on the times of planting and spacing of elephant grass which is used as a fallow crop on the station. An excellent cover now obtains on this field over all plots, and the ease with which this grass may be established on non-flood land at Domira Bay is confirmed. When it is decided to return this field to general cultivation it will be utilized for up-rooting experiments using various techniques. A further two acres is being used for experiments with pure stand elephant grass sown under maize in comparison with an elephant grass-velvet bean mixture.

EMPIRE COTTON GROWING CORPORATION.

INSECT PEST CONTROL WORK.

The following reports are made by Messrs. E. O. Pearson and B. L. Mitchell of the Insect Pest Control Staff.

I. LOWER RIVER DISTRICTS.

GENERAL. In the Lower River work has continued in the same seven centres as last year. A census has been made in each of a small, compact area in which the history of all native gardens has been recorded (the number in each area varying from 100-200), giving details of the crops grown and the dates of planting.

Based upon this census, selected gardens have been sampled continuously for insect populations, crop development and crop loss. This recording work has comprised the bulk of the year's activities.

Experimental work on planting dates, supported by large scale flower taggings and analyses of the fate of bolls produced, plant diagrams and bud marking, and the usual insect and meteorological records, has been continued at the Chiromo experiment station. Much of this work was ruined by the abnormal season.

Pupation studies on Red Bollworm have been maintained and improved: data from about 12,000 individuals will be available this season. These records have been fortified by studies of the incidence and causes of mortality in the field.

Continuous records of the life cycle of *Dysdercus* under insectary and field conditions have been started, mainly to find the extent to which climate inhabits breeding at certain seasons. Discussion of these is held over until next year.

CROP STATISTICS. Virtually no cotton was planted before mid-January, but two-thirds of the crop was sown in the fortnight ended 8th February. A proportion of this main planting and nearly the whole of the later plantings failed to establish themselves and it is estimated that only about half the gardens planted actually survived to contribute to the crop. Thus, although there was a decrease in yield *over all gardens* from 269 to 153 lb. seed cotton per garden, the yield per *effective* garden was practically unchanged, being about 260 lb.

These figures emphasise the fact that the shortfall in this year's crop was primarily due to the failure of gardens to establish themselves; where a stand was obtained at all, the yield was up to last year's level.

When the causes of crop loss are analysed it becomes clear how this rather surprising result was brought about. The figures below are obtained from analysis of weekly collections from all sample gardens in both years.

Table I. Comparison of Crop Production and Crop Loss, 1940-41.

Mean number of bolls per acre produced or lost from various causes, $\times 10.3$.

		Bollworm		Stainer		Other Causes		Clean		Total
1940	...	49.0	...	29.3	...	1.0	...	25.5	...	104.8
1941	...	14.8	...	2.8	...	1.5	...	23.4	...	42.5

It will be seen that the actual volume of damage due to bollworm was approximately one-third and that due to stainer was approximately one-tenth of that done by these insects last year. Thus, in spite of the fact that gross boll production was more than halved, net production was maintained at about the same figure.

CROP DEVELOPMENT AND LOSS. On account of the dry weather conditions and poor stands of interplanted maize, growth was compact and early flowering stimulated, nearly all the crop being made before the cool season. The contrast as regards time of crop production in the two years is shown by the following table, giving the actual volume of production by months (*i.e.* the actual number of non-shedding bolls harvested weekly, whether damaged or not).

Table 2. Seasonal Crop Production, 1940-41.

Mean number of bolls harvested per acre over all sample gardens, $\times 10.3$.

		May		June		July		August		September		October		Total
1940	...	3.9	...	10.5	...	19.7	...	22.1	...	38.6	...	9.9	...	104.7
1941	...	5.6	...	20.5	...	12.5	...	2.2	...	1.5	...	0.2	...	42.5

The incidence of bollworm damage upon this gross production is given below.

Table 3. Seasonal Bollworm Damage, 1940-41.

Mean number of bolls destroyed per acre by bollworm over all sample gardens, $\times 10.3$.

		May		June		July		August		September		October		Total
1940	...	3.2	...	7.9	...	11.9	...	9.4	...	12.7	...	3.9	...	49.0
1941	...	2.4	...	6.5	...	4.0	...	0.9	...	0.9	...	0.1	...	14.8

In 1941, 94% of the clean crop was harvested in May, June and July, as against 11% in these months in 1940. Combining the figures from tables 2 and 3 and comparing the proportionate bollworm damage in these months in the two years, we have:

Table 4. Percentage of Total Bolls Produced.

Destroyed by Bollworm.

		May		June		July
1940	...	82%	...	75%	...	60%
1941	...	42%	...	32%	...	32%

The yield per acre has, in fact, been maintained by a more efficient production of bolls from an exclusively early crop in 1941, compared with a relatively inefficient production of bolls from a predominantly medium and late crop in 1940.

RED BOLLWORM ACTIVITY. In spite of the very great differences in the character of the two seasons, the same general phases of bollworm activity have been recognisable. These consist of the initial infestation started by moths emerging in March and April, from the diapause fraction of the previous season's pupae; the main infestation of May-June, due to moths emerging from predominantly short-term pupae produced by the first phase in the new crop; and a third phase, from late June onwards, characterised by low moth activity and falling egg laying. A rough summary of the situation in the two years is given below; these figures represent the average values per weeks included within each phase of moth activity.

Table 5. Seasonal Bollworm Activity, 1940-41.

Totals per acre in each phase, $\times 10.3$.

		PHASE I			PHASE II			PHASE III		
		Egg-laying up to 3 May, larval pop. up to 10 May			Egg-laying 10 May-28 June, larval pop. 17 May-5 July			Egg-laying 5 July onwards, larval pop. 12 July onwards		
		Eggs	Larvae	5th Instar	Eggs	Larvae	5th Instar	Eggs	Larvae	5th Instar
1940	...	32.9	8.7	2.0	128.0	19.4	5.6	77.7	8.3	3.7
1941	...	96.7	11.0	1.9	81.3	12.3	3.9	55.3	5.5	1.6

It has already been pointed out that the great bulk of the 1941 crop matured in May, June and July, mainly the two latter months. These bolls will have been exposed to bollworm attack from mid-March, the critical period (taking into account the shape of the bolling curve and the period in the boll's life when it is susceptible to damage) being late April to mid July. This period covers, partly, the first phase but pre-eminently the second phase of bollworm activity. The smaller volume of damage in 1941 may thus be directly related to the diminution in size of the second phase, both absolutely and relative to the first phase, in 1941. Had anything approaching a normal rate of multiplication been attained, following the high initial infestation, the damage due to bollworm might have been anything from two to four times as large as it was.

The probable explanation of the differences in bollworm activity in the two years is as follows:—

(i) The number of eggs in the first phase is greater in 1941, due to earlier flowering of the crop, reduction in the effective acreage causing concentration of the egg-laying, and larger size of the late crop (from which the bulk of the diapause generation is derived) in 1940 than in 1939.

(ii) The larval population in the first phase is not anything like as large, proportional to the egg-laying, in 1941. This suggests increased mortality in the early larval stages: the ratio of total larvae to total 5th instar larvae is about the same in the two years, suggesting no difference in mortality in the later larval stages. The abnormally dry weather in April-May probably accounted for this increased mortality in early larval life, in which the newly hatched larvae are moving about the plant seeking food, before reaching the security of the interior of buds or bolls. During this phase of bollworm activity maximum saturation deficiencies were 29% greater and evaporation 57% greater, in 1941 than in 1940.

(iii) Egg laying in phase II is considerably less than in 1940, and larval populations correspondingly lower. It is this fact which permitted the maintenance of yield this year. The reduction cannot be explained by assuming merely that it was the result of a smaller moth flight, since the 5th instar populations, from which this flight is derived, were nearly the same in phase I in the two years, nor do the pupal records suggest any excessive mortality amongst, or shift in the form of emergence from, pupae derived from these populations. It seems more probable that the reduced egg-laying was due to lack of stimulus to, or direct inhibition of egg-laying, caused by climatic conditions and or early onset of plant senescence rendering the plants unattractive to moths.

(iv) The lower egg laying in phase II leads to a proportional diminution in the populations throughout the rest of the bollworm year, the mortality and reproductive rates apparently being very similar in the later stages of both years. There is thus an *absolute* diminution in 5th instar population in the third phase (*i.e.* from mid July onwards) of from 3,700 larvae per acre in 1940 to only 1,600 larvae per acre in 1941. As the effective acreage was about half as large in 1941, the gross 5th instar population in this phase was about one-quarter of that in 1940. This is, of course, of the greatest importance, since it is from these larvae that the carry over population of diapause pupae to the next season is derived. The prospects for a light initial infestation in 1942 are therefore good.

STAINER INFESTATION AND DAMAGE. The stainer infestation followed the same pattern as in 1940, but was of trifling size. Initial infestations of *Dysdercus intermedius* nowhere exceeded 250 adults per acre, breeding was restricted and no second generation of adults matured. As food supplies for young nymphs were plentiful throughout May, this must have been due to climatic conditions. *D. fasciatus* appeared in even smaller numbers, but persisted in the crop at a low level of breeding until, on the rising temperatures of August-September populations of 1-2,000 per acre were built up. These records confirm the suggestion made last year, that in the cool, dry season stainer infestations are limited by climatic conditions.

The extremely small infestation this year has resulted in a large increase in the proportion of clean cotton in the commercial crop, confirming our view that bollworm attack is felt chiefly as complete loss of crop, the commercial No. 2 being mainly composed of stainer damaged material. Thus along with the reduction in total loss due to stainer (based on analyses of crop loss from our sample gardens) from 28% in 1940 to 7% in 1941, the proportion of No. 1 in the commercial crop (based on market returns) rose from 72% in 1940 to 93% in 1941.

PUPATION RECORDS. By using the data on the time of emergence of moths from weekly collections of 5th instar larvae, integrated with the known field populations of such larvae at the time of collection, it is possible to determine the form, dimensions and origin of the seasonal moth flight, particularly that part of it which forms the initial infestation in the new crop.

The moth flight so constructed for the Chiromo district for the 1940-41 season showed two prominent peaks of moth emergence, one in mid December and the other in March. Only one-third of all this emergence took place after the time that any food became available from the generally late planted crop. Had planting taken place in, say early December, food would have been available for two-thirds of the total diapause flight and the initial infestation would have been double what it was.

Looking at the data another way, had it been possible to exclude pupae being produced in September-October, 1940—i.e. had the close season begun at the end of August—roughly 40% of the entire diapause flight would have been eliminated.

These results suggest two rational ways of limiting bollworm damage: by reducing the size of the initial infestation, *first*, by planting as late as possible, *secondly*, by uprooting as early as possible. It must be realised, however, that these two methods are to a great extent mutually exclusive. Cotton planted late will usually mature its crop after the cool season and will thus be bound to give rise to a large population of diapause pupae. In cotton planted early enough to make a pre-cool season crop and then cut out in July, the important August-October derived fraction of the diapause flight is eliminated, but the whole weight of the remainder falls upon the crop at a time when conditions are optimum for bollworm multiplication.

It is hoped that the continuation of these moth flight studies will point to some way out of this dilemma. One thing can, however, be confidently stated and that is that the practice of early planting combined with late cutting out is calculated to preserve the maximum possible population of bollworm.

II. LAKE SHORE AREA.

GENERAL. Routine field work on egg and larval populations and on pupal development in field cages have been continued and their essential results have confirmed those of previous years. The bulk of the work has been experimental, concerned with the factors effecting the length of pupal life. As many of the pupae under observation had not emerged at the time of writing this report, the results are not complete, but some of the experiments in hand are summarised below.

The following terms used here require some definition. These are:

- (i) "*Short-term*" pupae, which start to develop immediately after formation.
- (ii) "*Over-wintering*" pupae, in which development does not start until the rise of temperature after the cool season.
- (iii) "*Diapause*" pupae, which lie dormant over the hot, dry season and do not start to develop until after the beginning of the next rainy season.

The start of pupal development may be detected, and its course followed, by observation of the changes in the appearance of the fat body and pigmentation which are visible through the pupal cuticle. It appears that while there is some lengthening of the actual developmental period during the cool weather, the great prolongation of pupal life characterising over-wintering or diapausing pupae is due to a dormant period interposed between pupation and the start of development. Once a pupa has started to develop its behaviour and reactions appear essentially similar irrespective of the length of time which has elapsed since its original formation. Until development begins it is therefore impossible to distinguish between over-wintering and diapausing pupae. They are thus referred to simply as "*non-developing*" or "*long-term*" pupae.

EFFECT OF LARVAL FOOD ON PUPAL LIFE.

Larvae were fed on different classes of food, grouped according to age. Owing to technical difficulties in feeding, only small numbers of pupae completed development, but these included both short-term and over-wintering pupae from larvae fed on all food groups. This most important suggestion, *viz.* that diapause is *not* initiated by larval nutrition, is now being more rigorously tested under constant temperature conditions.

Rate of development and size of resulting pupae suggest that bolls 1-2 weeks old are the most suitable and small buds the least suitable food group.

EFFECT OF HUMIDITY ON LENGTH OF PUPAL LIFE.

As a result of very extensive experiments with pupae exposed throughout life to approximately constant humidities ranging from 50%-100% R.H., it is clear that humidity does not affect the length of pupal life and can be ruled out as a factor inducing diapause.

EFFECT OF REMOVAL OF PUPAL CELL.

Parallel lots of pupae removed from their cells, either completely naked or covered with $\frac{1}{2}$ " of loose dry soil, and normal pupae in undamaged cells have been observed in the insectary. Removal of the cell shortened pupal life by a short amount, in short-term pupae, and by a fairly large amount, in over-wintering pupae. Furthermore, naked pupae tended to show a group of mid-winter emergences which does not occur in enclosed pupae. Naked pupae covered with soil behaved in an intermediate manner. These results suggest that normal pupae may be lagged to such an extent by their earthen cells as to limit the brief period around the maximum each day when temperatures rise above a threshold of development in the cool season.

MEASUREMENTS OF PUPAL WEIGHTS AND WATER CONTENTS.

Non-developing pupae lose fresh weight fairly steadily and very slowly, the rate of loss, which is of the order of 0.25-0.50% per week, being very little affected by humidity. The water content remains approximately constant at about 60%. Clearly non-development is not induced by excessive moisture loss in the pupa at low soil humidities.

Developing pupae lose fresh weight rapidly,* the rate of loss being governed by, but not proportional to, the humidity. In April-May this rate of loss is about 1% per week at 100% R.H. and about 5.5% at 50-75% R.H. Despite this loss in gross weight, the moisture content of pupae which have developed to within 48 hours of emergence, tends to increase to 62-68%, according to the humidity, those pupae kept at higher humidities having the higher moisture content.

TOLERANCE OF SUBMERGENCE IN WATER.

Submergence of non-developing pupae for as long as four weeks has little lethal effect. Neither this, nor periodical three day long submergences in the early part of the warm, dry season had any effect in breaking up the diapause condition.

Submergence of developing pupae stops development at whatever stage it has reached. If prolonged for more than three days the results may be fatal, 80% dying after one week's immersion and all dying after 9 days immersion. If development recommences, there is merely a retardation of emergence of the same order as the length of the immersion.

The lack of moth emergences noted in periods of very wet weather may be due to this suppression of development by successive non-lethal submergences of developing pupae.

DISCUSSION.

These results strongly suggest that the question of whether a pupa will be a short term one or not is determined in the larval or pre-pupal stage. There are three possible determinants—larval nutrition, soil moisture contents acting on the pre-pupa and low minimum temperatures during larval life.

Further evidence is required regarding larval nutrition; this year's results, though suggesting that this is not a prime factor, require confirmation on a large scale.

Soil moisture contents clearly have a profound effect upon the pre-pupa, both directly and indirectly, by determining the amount of water it requires to construct the pupal cell. Its exact effect is still speculative.

We know from field evidence that both in the Lake Shore and the Lower River areas the formation of non-developing pupae coincides with the onset of the cool, dry season. It seems significant that in the Lake Shore areas only 50% of the emergences from pupae formed in May-June are short-term, whereas on the Lower River, where temperatures are then still high, over 90% are still short term. The proportion of short term pupae formed in the latter place only drops to 50% in July, the coldest month. On the other hand, the production of mainly long term pupae continues right on into the very hot, dry season, so that dryness seems to be the common factor throughout.

The post cool-season rise in temperature is accompanied by a flush of moth emergences from long term pupae which, in the field, is again suppressed in the hot, dry weather of October-November, there being no further emergences until the break of the rains. This suppression of emergence does not occur to the same extent under insectary conditions, where maximum temperatures are lower, which suggests that there is an upper limit of temperature above which development cannot commence.

The season's results show that humidity and soil moisture content are not directly responsible for the break up of diapause, since continuous high humidity and even prolonged immersion do not affect non-developing pupae. The controlling factors are still obscure and it is noteworthy that emergence of moths from diapausing pupae formed in one season may continue right through the following rains and even extend into the next warm dry season.

DISTRICT WORK.

DEMONSTRATION PLOTS—The object of these small plots is to give the native a practical demonstration of improved methods of farming by means of which the fertility of land under continuous cultivation can be maintained. Simple mechanical measures such as contour bunding and ridging are practised and fertility is kept up by the use of compost made in the rainy season and by rotations which include fallow periods under leguminous crops or elephant grass. A five course rotation is now in use on several plots in the Southern Province: 1. Grain; 2. Leguminous crop (beans or groundnuts); 3. Grain; 4. Roots; 5. Elephant grass or pigeon pea fallow. Correct cultivation and spacing of all crops is demonstrated and all plots are equipped with improved grain stores, which are quite simply constructed from local materials but are effective in keeping stored grain and other seeds comparatively free from attack by insects or vermin. Agricultural instructors encourage natives to visit these plots periodically and explain the work in progress.

There are now a large number of plots situated all over the Protectorate, most of which have been running for several years. In the Southern Province three of the older plots were handed over this year to the Native Authorities who will continue to run them on approved lines. In spite of the very dry season the majority of the plots produced relatively good crops, and on all of them yields considerably exceeded those obtained from neighbouring native gardens. This was particularly noticeable on the groundnut plots in the Northern Province where yields of 1,000 lbs. per acre were obtained in comparison with native gardens where the crop was almost a complete failure.

SOIL CONSERVATION—Steady progress has been made in this matter throughout the Protectorate, demonstrations, propaganda and assistance on all phases of soil conservation being given on a considerable scale. Where possible the Forestry and Veterinary Departments have co-operated in the work.

In the Southern Province a vigorous campaign to establish ridge cultivation, and to encourage the practice of burying of weeds and crop residues, was carried out in the districts of Blantyre, Central Shire, Mlanje, Cholo and Chiradzulu. This work has met with marked success, particularly in Blantyre, Central Shire and Chiradzulu where the Native Authorities have now made rules enforcing these measures. In the Lower River area south of Port Herald extensive work was done on storm drainage with the object of protecting cultivated land from the water pouring off the hills above. About five miles of storm drains were put in along the base of the foothills. In Chikwawa District the scheme allowing new gardens or extensions to be opened in the hills only after inspection and the issue of a permit has continued to be effective in checking misguided use of land. All wheat gardens in the Neno Hills have been bunded and planting of new gardens is forbidden until they are fully protected.

Preparatory to an extensive soil conservation programme which will gradually be applied to the whole Protectorate, a team, comprising the Agricultural Officer, Mlanje, the District Commissioner, Cholo, and the Assistant Conservator of Forests, has been carrying out detailed investigations in the Native Trust Land area of Cholo District where the topography of the land and the density of the population make soil conservation measures particularly necessary. Two experimental areas were chosen and a detailed agricultural survey made in order to ascertain the economy of the inhabitants and other essential facts, and a land usage programme based on the information obtained was formulated. This programme was approved by Government in respect of one area and put into operation towards the end of the year.

The main points of the programme are:

1. All slopes greater than 1 in 3½ have been closed to cultivation, these areas being permanently marked off by planting lines of bamboos.
2. In the areas remaining open to cultivation land has been redistributed and protected against erosion by contour ridge terraces and by cultivation ridges on the contour.
3. No land not under cultivation may be opened without permission.
4. A set of rules laying down certain measures of soil conservation and good husbandry have been drawn up and the Native Authorities made responsible for seeing that these are carried out. These rules provide for the early burning of grass on uncultivated land, regulate the construction and protection of storm drains, and require the grassing of bare ground in the vicinity of houses, which was found to be a common starting place for considerable erosion.

In the Ncheu District an expansion of the work has continued in 1941. Further native instructors have been trained and have carried out contour bunding and general propaganda over a considerable part of the district. The Nkhonde station has been developed as a centre for demonstrating methods of soil conservation and a model holding laid out on a site badly in need of such work.

In the Misuku Hills work was commenced in 1938 in order to remedy the very unsatisfactory state of affairs which had arisen as a result of population density, deforestation and mismanagement of cattle. The initial doubts and resentment of the conservative Asukwa people have been overcome and great progress has been made with their willing co-operation. A variety of measures for the prevention of erosion have been used extensively and successfully, including contour bunding, contour ridge planting, strip cropping, bench terracing, gully protection, and the protection of stream banks. The damage formerly done by surplus cattle to gardens in the valley bottoms, which form the major part of the land suitable for crops, has been checked by arranging alternative grazing grounds, at a distance from the villages, where cattle surplus to village requirements are herded communally. The establishment of forest reserves and village forest areas has also played a great part in this work.

DISTRIBUTION OF SEEDS AND PLANTS—Considerable quantities of seed of various crops have been supplied free or sold to natives on the principle of, first, free issues to introduce a crop or improved variety into a district, and, secondly, by sale of seed or exchange for an equal weight of native seed where a crop is already established and where shortage may be due to the improvidence of the native. The main crops of which considerable issues of selected seed have been made are rice, bulrush millet, groundnuts, wheat, pigeon pea and potatoes. Mention has already been made of the free issue of 141 tons of sweet potato cuttings in order to ease the food situation on the Lower River. A large number of budded orange, lemon and grapefruit trees, on rough lemon stock, were prepared and issued to natives from the Mlanje Experimental Station. This station also distributed a quantity of vegetable seeds, mainly lettuce, spinach, tomato and peas.

A scheme for the multiplication and distribution of European potato seed stocks has been started. Seed obtained from Dedza was planted in a small seed farm in the Neno Hills where it was regularly inspected and rogued. Imported seed of the variety "Up-to-Date", from South Africa, was planted in five small increase plots at Namwera, Chirimba, Mlanje and Kumtaja.

MISCELLANEOUS—Courses of instruction in compost making were held during the year at Chirimba (Blantyre), Port Herald and Mlanje. Natives showed great interest in this work and the courses, which lasted several months, were well attended.

Seventeen agricultural instructors went through a three-months' course of general agricultural training, with the emphasis on soil conservation, at the Mlanje Experimental Station and were afterwards posted to various parts of Cholo and Mlanje Districts. Training in soil conservation methods was also given at Nkhonde, under the Native Welfare Committee's soil conservation scheme, and at other places in the Northern Province.

The encouragement of bee keeping and the production of good quality wax continued to receive attention in the Northern Province. Attempts are being made to develop a market for honey as well as to increase wax production.

SOIL SCIENCE AND CHEMISTRY.

The Assistant Chemist was occupied mainly with duties unconnected with this department until his departure in June.

Dr. Arnold was appointed Agricultural Chemist and Research Officer in October when essential chemical analytical work was resumed. He has been occupied mainly with matters which have arisen from the war conditions but some advisory work has been possible.

PART III—SUMMARY OF LEGISLATIVE CHANGES.

There were no legislative changes during the year 1941 which were directly concerned with agriculture in the Protectorate.

ACKNOWLEDGMENTS.

This report gives a resumé of the progress made and the results achieved during the past year. Admittedly there is no justification for complacency but there is certainly no need for pessimism. Considering the appreciable percentage of our man-power serving with the armed forces or engaged abroad on other productive work, the results achieved on the "Home Front" are encouraging, and one can look forward with confidence to an ever increasing productive effort with a resultant increase in the volume and variety of crops produced.

I take this opportunity of acknowledging the assistance this Department has received from members of the planting community and from officials and non-officials who have co-operated so whole-heartedly and taken so active a part in all the projects which have produced the results enumerated in this report. The next advance from self-sufficiency is surplus production in all areas to create reserves to meet any combination of circumstances which may arise or to supply essential foodstuffs to other parts of the Empire.

A. S. RICHARDSON,
Director of Agriculture.

EUROPEAN AGRICULTURE 1941.

Name of District.	Total acreage under cultivation.	TOBACCO.								TEA.		COFFEE.	
		Total.		Fire-cured.		Flue-cured.		Air-cured.		Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.
		Acres.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.				
Lower Shire ..	90 ³ ₄	3	20	...	...	...	...	3	20	...	...	...	...
Chikwawa ...	125	105	580	...	...	105	580	...	...	...	...	...	...
Central Shire ...	310	180	1,020	40	203	140	817	...	...	...	...	...	...
Cholo ...	19,180	2,249	9,813 ¹ ₂	70	378	2,179	9,435 ¹ ₂	...	...	9,484 ¹ ₂	54,142 ¹ ₂	2	...
Mlanje ...	11,184	760	3,012 ¹ ₂	238	1,060	497	1,871 ¹ ₂	25	81	9,417	60,790	10	6
Blantyre ...	2,210 ¹ ₂	1,272	7,233	120	643	1,152	6,590	...	...	...	...	65	50
Chiradzulu ...	589	395	1,920	...	...	350	1,709	45	211	...	...	...	...
Zomba ...	2,056 ³ ₄	953	3,401	64	271	889	3,130	...	...	...	...	...	...
Upper Shire ...	148 ¹ ₂	...	...	...	...	...	...	...	...	...	...	...	...
South Nyasa ...	1,167	1,042 ¹ ₂	4,328 ¹ ₂	...	...	1,042 ¹ ₂	4,328 ¹ ₂	...	...	...	...	...	...
Ncheu ...	428 ³ ₄	205	932 ¹ ₂	35	250	170	682 ¹ ₂	...	...	...	...	...	...
Dedza ...	215 ¹ ₂	20	55	...	...	20	55	...	...	...	...	...	...
Fort Manning	98	80	189 ¹ ₂	5	6	15	47	60	136 ¹ ₂	...	...	...	...
Lilongwe ...	598 ³ ₄	301	1,423	65	663	80	240	156	520	...	...	...	...
Dowa ...	2,387 ¹ ₂	20	35	...	...	...	...	20	35	...	...	...	...
Kota Kota ...	10 ¹ ₂	...	...	...	...	...	...	...	...	...	...	...	1
Kasungu ...	3	...	...	...	...	...	...	...	...	...	...	...	...
Mzimba ...	128	...	...	...	...	...	...	...	...	...	...	2	1 ¹ ₂
West Nyasa ...	1,332	...	...	...	...	...	...	...	...	...	...	...	...
North Nyasa ...	27	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	42,289 ¹ ₂	7,585 ¹ ₂	33,963 ¹ ₂	637	3,474	6,639 ¹ ₂	29,485 ¹ ₂	309	1,003 ¹ ₂	18,901 ¹ ₂	114,932 ¹ ₂	79 ¹ ₂	59 ¹ ₂

NOTE:—TEA : Acreage in plucking in 1941 was 16,694¹₂. COFFEE : Acreage in bearing in 1941 was 58¹₂.

EUROPEAN AGRICULTURE—CONTINUED.

Name of District.	SISAL.		COTTON.		RUBBER.		CHILLIES AND CAPSICUMS.		MAIZE.		WHEAT.	
	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.
Lower Shire ...	...	1	...	12 ¹ ₂	...	3 ¹ ₂	...	...	68	465	...	...
Chikwawa ...	...	...	...	2	...	3 ³ ₄	...	...	3	40	10	11
Central Shire ...	...	...	...	...	...	...	...	...	30	253 ³ ₄	...	...
Cholo ...	820	6,340	...	...	...	...	...	...	118 ¹ ₂	1,207	14	15
Mlanje ...	...	...	...	...	...	...	13	19	119	481	...	...
Blantyre ...	...	...	...	6	20	...	...	...	127	1,330	3	4 ¹ ₂
Chiradzulu ...	...	...	...	...	...	...	27	53 ¹ ₂	90	860	...	...
Zomba ...	3	...	...	5 ¹ ₂	7	...	50	11 ¹ ₂	166	1,503 ¹ ₂	2 ¹ ₂	8
Upper Shire ...	...	...	...	...	...	...	...	...	106	312	...	...
South Nyasa ...	...	...	...	...	...	...	3	15	101	1,501 ¹ ₂	...	...
Ncheu ...	...	...	...	...	...	...	...	...	166	263	2	7
Dedza ...	...	...	...	71	90	...	...	...	66	520	8	6 ¹ ₂
Fort Manning ...	...	...	...	...	...	...	...	...	...	...	1	4
Lilongwe ...	...	...	...	...	...	...	...	...	163 ¹ ₂	1,112	21	8 ¹ ₂
Dowa ...	...	...	...	60	81	...	...	...	2,019	6,529	2	...
Kota Kota ...	...	...	...	...	...	...	...	...	4	2	4	...
Kasungu ...	...	...	...	...	...	...	...	...	...	...	...	...
Mzimba ...	...	...	...	...	...	...	...	...	8	20	7	14
West Nyasa ...	...	...	...	...	1,310	1,749	...	...	15	700	...	...
North Nyasa ...	...	...	...	...	...	...	...	...	10 ¹ ₂	54	...	...
Total ...	824	6,340	157	205 ¹ ₂	1,310	1,749	93 ¹ ₂	201 ¹ ₂	3,383 ¹ ₂	16,754	74 ¹ ₂	24 ¹ ₂

NOTE: SISAL: Acreage harvested in 1941 was 140.
RUBBER: " tapped " " " 1,200

EUROPEAN AGRICULTURE—CONTINUED.

Name of district.	LEGUMES.							OIL SEEDS.					
	Total.		For food.		For fodder.		For green manure	Total.		For crushing.		For food.	
	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.
Lower Shire ...	2 ³ / ₄	3	2 ³ / ₄	3	...	...	...	3 ¹ / ₂	2 ³ / ₄	...	...	3 ¹ / ₂	2 ³ / ₄
Chikwawa ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Central Shire ...	84	...	...	...	...	...	84	...	...	...	...	...	...
Cholo ...	768	1,023	7	6	105	1,017	656	1,146 ³ / ₄	6,296	1,141 ³ / ₄	6,266	5	30
Mlanje ...	409	12	5	12	120	...	284	25	10	20	...	5	10
Blantyre ...	315	95	29	95	115	...	171	4	31	...	...	4	31
Chiradzulu ...	52 ¹ / ₂	108	22 ¹ / ₂	108	10	...	20	1	12	...	...	1	12
Zomba ...	400	778	177 ¹ / ₂	582	39	196	183 ¹ / ₂	34 ¹ / ₂	179 ¹ / ₂	29	156	5 ¹ / ₂	23 ¹ / ₂
Upper Shire ...	28	42	26	42	1	...	1	6	7	...	...	6	7
South Nyasa ...	20	...	...	...	...	...	20	...	...	...	...	...	...
Ncheu ...	46	1	1	1	...	...	45	...	...	...	...	...	...
Dedza ...	13	90	13	90	...	...	...	9	30	...	...	9	30
Fort Manning ...	6	6	6	6	...	...	...	...	...	...	...	...	...
Lilongwe ...	70 ¹ / ₂	38	17 ¹ / ₂	38	3	...	50	35	222	25	180	10	42
Dowa ...	61	61	61	61	...	...	...	166	250	...	...	166	250
Kota Kota ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kasungu ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mzimba ...	17	8	17	8	...	...	...	4	...	...	...	4	...
West Nyasa ...	...	...	...	...	...	...	...	7	28	...	...	7	28
North Nyasa ...	...	...	...	...	...	...	...	5	23	...	...	5	23
Total ...	2,292 ³ / ₄	2,265	385 ¹ / ₄	1,052	393	1,213	1,514 ¹ / ₂	1,446 ¹ / ₄	7,091 ¹ / ₄	1,215 ³ / ₄	6,602	231	489 ¹ / ₄

EUROPEAN AGRICULTURE—CONTINUED.

Name of district.	TUNG OIL.		FRUIT TREES.		NUT-BEARING TREES.		MISCELLANEOUS.		Woodland Artificially Established
	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres under crop.	Yield cwt.	Acres.
Lower Shire ...	...	...	...	...	...	...	...	...	16 ¹ / ₂
Chikwawa ...	...	...	5	5	...	...	...	...	9
Central Shire ...	...	...	16	40	...	...	...	...	70
Cholo ...	4,487	642	79	19	9	...	2 ¹ / ₂	...	5,714
Mlanje ...	414	32	26	...	...	...	...	...	3,848 ¹ / ₄
Blantyre ...	403	9	15	6	...	...	...	...	3,396 ¹ / ₂
Chiradzulu ...	20 ¹ / ₂	18	3	6	...	...	...	...	1,468 ¹ / ₂
Zomba ...	409	135	9 ¹ / ₄	2	22	...	...	...	3,010 ¹ / ₂
Upper Shire ...	1 ¹ / ₂	...	8	14	...	...	...	...	30 ¹ / ₂
South Nyasa ...	...	...	1 ¹ / ₂	...	...	...	...	...	409
Ncheu ...	...	...	9 ¹ / ₂	1	...	...	...	...	226 ¹ / ₂
Dedza ...	2	...	26	141	...	...	...	...	291 ¹ / ₂
Fort Manning ...	...	...	11	9	...	...	...	...	164
Lilongwe ...	7	2	20 ³ / ₄	72	...	...	...	...	1,886
Dowa ...	...	...	3 ¹ / ₄	32	26	...	...	...	244 ¹ / ₂
Kota Kota ...	...	...	2	20	...	...	...	...	20
Kasungu ...	...	...	3	2	...	...	...	...	6
Mzimba ...	87	...	3	...	...	...	...	...	118 ¹ / ₄
West Nyasa ...	...	...	...	...	...	...	...	...	2 ³ / ₄
North Nyasa ...	...	...	...	...	...	...	11 ¹ / ₂	12	11
Total ...	5,830	838	240 ¹ / ₄	369	57	...	14	12	20,943 ¹ / ₂

NOTE: TUNG TREES: Acreage harvested in 1941 was 1,016

FRUIT TREES: Acreage harvested in 1941 was 82³/₄

NATIVE AGRICULTURE.

District.	Seed Cotton	Rice	Wheat	Ground- nuts	Tobacco
	Tons.	Tons.	Tons.	Tons.	Tons.
Lower Shire	648	52	...	4	...
Chikwawa	691	20	...	2	...
Central Shire	129	...	6 $\frac{1}{4}$	6	...
Cholo	138	8	...	3	42
Mlanje	...	20	...	5	762
Blantyre	included in Central Shire	...	...	10	71
Chiradzulu	...	...	...	2	394
Zomba	...	5	...	3	574
Upper Shire	142	10	...	50	191
South Nyasa	7	5	...	2	15
Ncheu	69	...	8	2 $\frac{1}{2}$	381
Dedza	119	11	89	48 $\frac{1}{2}$	180
Fort Manning	...	...	...	...	387
Lilongwe	...	...	...	14	3,761
Dowa	405	*	...	*	996
Kota Kota	191	580	1 $\frac{1}{2}$	...	322
Kasungu	...	...	...	...	116
Mzimba	...	*	6	*	...
West Nyasa	...	43	...	...	...
North Nyasa	362	29	...	...	...
Total	2,901	783	110 $\frac{3}{4}$	152	8,192

NOTE—Maize is the staple foodstuff in most districts; groundnuts, rice, wheat, beans and various other crops are also grown by natives for local consumption, but it is impossible to make an accurate estimate of the quantities of any of these crops. The figures for rice, wheat and groundnuts are amounts actually sold in districts.

The above tobacco and cotton figures represent the quantities purchased in each district, and do not accurately reflect the production by districts, as many natives grow their tobacco and cotton in one district and sell in another.

* Unrecorded sales took place in these districts.

LIVESTOCK OWNED BY NATIVES AT 31ST DECEMBER, 1941.

District.	Cattle.	Sheep.	Goats.	Pigs.
Lower Shire	361	1,428	7,004	4,842
Chikwawa	600	1,500	8,000	5,000
Central Shire	1,360	780	6,500	836
Cholo	101	706	3,002	3,021
Mlanje	1,375	2,936	12,906	3,574
Blantyre	3,200	1,266	8,840	3,000
Chiradzulu	4,200	1,420	10,900	8,000
Zomba	1,639	4,030	7,535	2,370
Upper Shire	45	2,308	6,266	370
South Nyasa	660	7,036	9,590	100
Ncheu	18,300	2,500	11,400	900
Dedza	26,194	3,317	21,128	411
Fort Manning	4,268	1,348	5,360	7,756
Lilongwe	57,702	Unknown	Unknown	Unknown
Dowa	21,000	5,200	31,500	2,100
Kota Kota	1,875	1,760	18,739	182
Kasungu	3,200	1,600	5,000	300
Mzimba	45,579	4,000	20,000	500
West Nyasa	2,100	120	1,200	—
South Nyasa	No Recent	Census	Figures	
Total	193,759	43,254	204,870	43,262

LIVE STOCK OWNED BY EUROPEANS AT 31ST DECEMBER, 1941.

District.	Cows and heifers.	Bulls.	Oxen.	Calves.	Pedigree cattle.	Horses.	Mules.	Donkeys.	Sheep.	Goats.	Pigs.
Lower Shire ...	172	13	135	228	—	—	—	44	114	38	25
Chikwawa ...	392	8	155	153	5	—	—	—	—	—	—
Central Shire ...	62	4	23	29	1	—	—	2	8	8	82
Cholo ...	1,386	39	768	726	11	34	1	4	182	28	48
Mlanje ...	1,425	30	976	557	6	2	—	1	193	12	123
Blantyre ...	1,032	20	401	479	35	3	—	—	—	11	278
Chiradzulu ...	630	9	263	277	14	3	—	—	10	—	22
Zomba ...	968	17	531	351	26	15	—	27	127	37	57
Upper Shire ...	7	1	1	1	—	—	—	—	—	50	40
South Nyasa ...	105	5	56	32	—	—	—	—	48	127	—
Ncheu ...	218	7	83	58	1	—	—	2	69	—	53
Dedza ...	173	5	76	52	—	—	—	—	—	12	56
Fort Manning ...	111	37	41	30	—	—	—	4	38	—	37
Lilongwe ...	275	11	232	125	—	8	—	44	27	—	182
Dowa ...	7	2	8	2	—	—	—	—	33	14	—
Kota Kota ...	35	2	21	11	—	—	—	1	5	1	—
Kasungu ...	—	—	—	—	—	—	—	—	—	—	6
Mzimba ...	11	1	24	2	—	—	—	2	32	—	48
West Nyasa ...	21	1	24	6	—	—	—	—	4	—	12
North Nyasa ...	41	2	65	19	—	—	—	—	61	—	56
Total	7,071	214	3,883	3,138	99	60	1	132	951	338	1,125

